BIO-DYNAMICS

A periodical furthering soil conservation and increased fertility in order to improve nutrition and health.

SPRING 1954

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VOL. XII NO. 2

Published and Copyright (1954) by the

BIO-DYNAMIC FARMING AND GARDENING ASSOCIATION, INC.
R. D. 1, CHESTER, NEW YORK

"Bio-Dynamics" Trade Mark Registered - Price 40c a copy; $1.50 a year

COMPOSTING COFFEE WASTE AND MANURE AT GOLDEN ACRES FARM

WALTER STUBER AND PETER BLASER

Biodynamic farming—the production of wholesome food of high quality—is one out of the extensive complex of vital questions inspired by Dr. Steiner, especially through his agricultural course held at Koberwitz in 1924. The principles which he outlined there have been worked out further and practiced by a relatively small number of farmers and gardeners. They have proved to be right wherever they have been conscientiously followed.

Today we still speak of biodynamic farming as a new, modern method without being able to point to a large number of examples, where the method has been applied successfully, except for small areas such as vegetable gardens and some family farms. This is not quite true of Europe, where before the war there quite a few big estates and a number of good-sized farms especially in Eastern Germany which were converted to B.D. management, but most of these have been expropriated by the communists. Now, a relatively small but slowly increasing number of farms are working along this line with good results. But we must not forget that the European farmer can still afford more than twice as much labor and that the average farms in the old countries are much smaller than here. This makes it easier for them to switch over to the B. D. method, and to carry through all the required special work such as composting, stirring and spraying preparations etc., as most of this work can still be done by hand or with simple, cheap machinery.

The situation on the medium-sized or large farm in the United States is entirely different; two to three men have to do all the work on 200 acres or more. This means that almost any work has to be brought down to the point where machinery and labor-saving devices can be used to save backbreaking labor and to reduce the required time to a minimum. In the matter of converting such a farm to the B. D. method the special work has to be fitted into the same scheme. There is still a long, hard way to go to find out how to make the very best use of our means of production in accordance with B. D. principles on an economically sound basis.

We must give Dr. E. E. Pfeiffer especial credit for having worked out these principles on the basis of an unbelievable num-

ber of scientific and practical tests, and brought them to a point where the orthodox, chemically trained and minded farmer can also understand them. Through his work Dr. Pfeiffer has actually built bridge after bridge for us from orthodox theory and farm practice to the modern B. D. conception and practice. It is now the task of the practical farmer to learn how to use these bridges.

And that is what we are trying to do on Golden Acres Farm. We want to prove that the average American farmer can switch over to B. D. management without risking more than his old materialistic ideas of farming problems. Within a few years we hope to be able to work out each of the special B. D. measures in such a way that the average farmer can carry them through without extra cost on labor and with very little expense for special equipment.

We prefer to introduce the B. D. measures step by step to our farming program. Instead of trying to make all the refinements at once, we want first to be sure about the fundamentals which for us are: soil management, crop rotation, also the management and care of the pastures; and now, as special B. D. measures, the production of compost, the spraying of B. D. Starter on crop residues in the field, and the use of the humus preparation 500 and preparation 501. Our aim thereby is to be self-supporting as far as the feed for our dairy—as well as for our chicken and steer operations—is concerned. In addition to that a large-scale production of B. D. vegetables and fruit is planned as soon as we find enough demand for it and a suitable means of distribution. All the above named fundamentals are essential links in the chain of management of the individual B. D. farm organism, and the strength or weakness of each link determines the success of the whole operation.

This year we concentrated on finding an effective and economical way of producing enough compost to supply each acre every third year with ten tons. This requires more raw material than the farm can supply in the form of manure, and we make use of other organic material which would otherwise be wasted. That means we get at the present time around five tons of coffee grounds daily which we are mixing with our cow and chicken manure. There are many other sources of such material, such as garbage, etc.

We did not take this up because we think that our own production would not be sufficient to bring the fertility of the land

up to a high level and keep it there, but we feel that through this acceleration of our compost production we will reach our aims in a shorter time, and that this allows us a more efficient crop rotation, using intercrops for grazing or silage rather than for green manure. Then too, the coffee grounds with their granular structure and considerable content of sand (which is used in the process of extraction) will improve the structure of our heavy soils and help us to get a better balance between the factors governing soil life. We must give Dr. Pfeiffer credit for the process used in composting this mixture of manure and coffee grounds together with some lime and topsoil in the proportion of 40% manure, 50% coffee grounds and 5% each of ground dolomitic limestone and topsoil. The quick and effective decomposition of the raw materials and the formation of a humus-like end product first became possible on a larger scale with the help of the B.D. Compost Starter developed by him.

In this process it has been possible to turn the raw materials into an alkaline humus with a pleasant earthy smell within a period of less than three months. As the coffee grounds are very acid, with a pH of around 5, we were anxious to see how the final product of our mixture would turn out in this regard. The tests of the compost thus produced revealed that it was an alkaline material with a pH between 7.5 and 8.3.

We feel that the B. D. Starter has a big part in this result; also the aeration of the piles, which we try to make as loose as possible by means of an ordinary power-take-off type manure spreader used stationary, has a good effect.* We find it very important to neutralize our soils as this is fundamental for a good stand of legumes in our hayfields and pastures which in turn provide the soil with nitrogen and improve its tilth.

The crop of corn that was produced on our farm this year, estimated to be 140 to 150 bushels per acre from one 18 acre field, fertilized with ten tons of compost per acre, also seems to prove that we are not far off from the way to a B. D. farming program that can stand in competition with any other method. This corn had only one treatment with the rotary harrow after the first germination of weeds and one cultivation; no side-dressing of any kind was used.

The process of making the compost is now developed in such a way that one man all by himself is able to mix and pile

* A detailed description of the building and handling of the compost piles with farm equipment will follow in the next issue.—Ed.

at least ten tons an hour (nearly a hundred tons a day) with no other equipment than a Jeep with power-take-off to drive the manure spreader (which is used stationary but must be moved ahead as the pile is built up behind it) then a tractor with front-end loader to dump the ingredients of the mixture alternately into the spreader. The action of the beaters on the spreader makes a satisfactory mixture and a pile with an ideal structure. Then we have a tank wagon with mounted pump, which is otherwise used to haul liquid manure; this is filled with the Starter solution, enough for 50 tons of raw material. By means of the pump and a garden hose which is connected to a nozzle on the rear end of the spreader the solution is sprayed against the beaters and gets distributed evenly in the mixed material. The finished piles are then covered with a light layer of straw to prevent too much evaporation and the formation of a hard surface crust. After three to four weeks we turn the piles over with the front-end loader to get an even decomposition. As the coffee grounds develop an enormous heat we have to water the piles during periods of drought to keep the moisture at the 40 to 50% recommended by Dr. Pfeiffer.

To be able to work during wet weather a concrete platform 100 by 100 feet was built two years ago. This summer we enlarged this area by a 15 foot wide strip of bare soil all around the platform, bordered by a dirt bank. A row of birch trees planted 10 feet apart along the outside of the bank will provide shade, and the dynamic effect of the white birch which is especially active in the root area will further improve the quality of our B. D. fertilizer.

With this strip of bare soil around the platform we are now able to stay on the concrete with our machinery for mixing and piling, and after the first period of fermentation is over, we turn the pile towards the dirt bank and let it ripen there until we want to use it. A drainage system takes care of the surplus moisture which runs off the piles and is collected in a big tank from which it is either pumped back on the compost if required or we use it on the pastures.

We hope that with these few words we have given you an idea of what we are doing on Golden Acres. We are finding out how to help other farmers, who are interested in our work, to get along with their own problems under their specific conditions. We are doing this the hard way, by practical experience. We look forward to reporting again when some more of our plans have materialized.

WHEN DOES AN INSECT BECOME A PEST?

ALICE HECKEL

If you were to ask a boy bug collector this question he might say, thinking of mosquitoes, well when they bite me. The farmer will answer that in the first place they lower the quality of his crops and in the second place they may even be the cause of total crop losses. This last with its widespread disrupting influence on the economy as a whole is the chief concern and worry of the Department of Agriculture, farm mortgage groups, the stock market broker, and the consumers.

There are many figures available which demonstrate the power of the insect as an economic pest. For instance, the estimated losses due to some 60 insects, compiled in 1938 by J. A. Hyslop of the Department of Agriculture, added up to a total damage of 1 billion, 601 million, 527 thousand dollars annually. This included the cost of control measures. A specific example is furnished by the estimated losses due to the European Corn Borer from 1939 through 1950. These begin at nearly 4 million dollars in 1939 and progress quite steadily up to 1945 when the loss was 36 plus million. Suddenly in 1946 the total leapt to 96 million and by 1949 was way up to 349 million dollars. In 1950 it dropped to 84 million; in that year weather conditions unfavorable to its development helped to check it, as well as control measures.

A study of this table also yields a picture of the spread of the borer through the corn belt. It also points to another answer to the question posed in the title of this article. An insect often becomes a pest when it arrives in another part of the world where its native enemies are absent and where its favorite food is spread out before it in abundance. The Corn Borer, for instance, was discovered in 1917 on sweet corn in market gardens near Boston. Tracing back, it was found that the creatures had come into the country on broom corn a few years before then, probably from Italy or Hungary, which had been imported as raw material for a broom factory in Medford, Massachusetts. It has spread out from there, sometimes slowly, sometimes more quickly in the intervening years. By 1952 it had been reported in 37 States east of the Rockies.

Another partial answer to our first question is also hinted at in the progressive spread and increase of this pest, and this has to do with the balance of nature and the damage done by

our disturbance of it. Of course, we do grow a great deal of corn in the United States; first to fatten our livestock, and second to feast on ourselves. (Most Europeans, Middle Europeans anyhow, just don't like corn, corn bread, etc.) It is one of our native plants. It thrives here. But there is also the fact that hundreds and thousands of acres of corn make happy hunting and breeding grounds for borers. Monocultures are meccas for many insect pests.

Colorado Potato Beetles used to live quite peacefully, and just enough of them, on a common weed belonging to the potato family, South of the Border, in Mexico. It followed this weed north, and went on living its rather limited provincial existence on this host plant. Then settlers pushing to the west presented it with potato plants as a more delicate and juicier dish, and more of it too, so they have since eaten their way all over the United States and taken a boat trip to Europe too. At a B.D. agricultural conference in Switzerland in 1938 their invasion of Europe via a port in southern France was being discussed. Among the questions then being considered was whether they would by-pass Switzerland because of the mountain barriers and how far they would spread in the end. Their possible route was being traced out on the basis of where there were larger acreages planted to potatoes, since the creature now limits its diet exclusively to potatoes.

There are other insects which do not feed exclusively on one sort of plant. A good example of one which likes a diversified diet is the Japanese Beetle. They were first discovered in a nursery near Riverton, N. J. in 1916. The man who found them, Harry B. Weiss, did not know what they were at first, nor did anyone else. Insect literature only said that they were common on the main islands of Japan but were not a serious pest. We all know here in the East how they have spread out in widening circles, and about the various measures that have been taken to try to prevent their spread. It is now known that they may feed on 275 different kinds of plants! One might call this a catholic appetite with a vengeance. In this case too, the beetle arrived without its natural enemies which keep it in balance in its native habitat.

It is pretty obvious that there must exist a balance of factors in Nature as far as the insects are concerned, and this can even be seen in the numerical relationship between the insects and the rest of the classified animal world. The total number

of described species of animals ranges from 823,000 to 1,115,000; the estimated numbers of kinds of insects runs from 600,000 to 900,000. These are all estimated numbers, sort of round figures. Again in round figures, then, probably 70 to 80 per cent of all the known kinds of animals are insects. Then if you think of the number of eggs 1 individual of 1 species lays in a season (these vary from hundreds to thousands) multiply this by the number of individuals in a species in a given area, —things would certainly get out of hand if all of these came to maturity without interference.

Aside from weather factors, availability of favorite foods, as well as the varying 'normal' cycles of individual species, which all help keep things in balance, there are many insects which aid man considerably in keeping destructive insects in check. We are all familiar with some of them: the lady bugs or beetles, which carry on life-long war on the aphids—not only the adult beetles but the larva of some species hatch out of eggs which have been laid nearby or right on the aphids and take up the work shoulder to shoulder with their parents.

In addition to them there are other insects which prey on those which are apt to become harmful to crops we grow or to man himself. The dragon flies and damsel flies with their great speed prey on mosquitoes and other small insects. Their young, called nymphs, which live in the water also consume mosquito wrigglers and other water insects, helping to maintain balance there. Then there are the aphis lions, the young of delicate, lacy-winged insects with rather long antennae and golden eyes. There are 15 families in this group and they feed on many kinds of harmful insects, eggs of many caterpillars, all stages of mites which feed on plants, scale insects, aphids and mealy bugs.

There are many others which act as parasites. Usually the larva of the parasite enters the living body of the host and feeds on its tissues until it is nearly fully grown, then the host dies. There are many of these parasites, many species of flies; the grasshopper maggot is one of these. The grown flies come out of the soil in spring, mate, and deposit maggots on grasshoppers usually while the grasshopper is on the move. The maggots are sticky and the fly darts down and drops one of these on the grasshopper. The maggot bores into the hopper and eats itself into a large maggot. The host dies and the maggot crawls out and pupates in the soil.

Many wasps consume all kinds of other insects. Yellow-jackets destroy many caterpillars like the corn earworm and army worm. (This is, of course, small comfort to the luckless person who unwittingly steps into a yellow-jacket nest!) They paralyze victims, take them home to their nests and often lay an egg right on top of them. The larva hatches out, eats the assembled larder and goes on from there through its various stages of development.

Insects are also helpful to man in that they are indispensable pollinators of plants. What would the farmer growing acres of clover for seed do without their help? In a laboratory greenhouse one can cross pollinate and hybridize with a camel's hair brush, but is helpless in the face of the myriad blossoms on an acre of alfalfa. Many insects other than honey bees work at pollination, thrips, butterflies, ants, beetles, flies, wasps, and wild bees—bumblebees. An article by F. C. Bishopp of the Bureau of Entomology & Plant Quarantine, points to something that is being more widely recognized in the world today. He speaks of the increasing importance of the use of the honey bee in the pollinizing of food crops and goes on to say: "Intensive cultivation of land and the general use of insecticides are rapidly eliminating native pollinating insects." (We have all read of the migrating bee keepers who haul their apiaries south in the winter and follow the blossom time north until they reach home grounds again in spring, hiring themselves out to make fruitful orchards and seed beds wherever they find them.)

The same gentleman tells an interesting story about insects which do not feed entirely on plants we want to cultivate. Many, of course, as you know live and feed on weeds. I have already told you about the Colorado Potato Beetle following its host plant across the border. This tale is about the control of the prickly pear in Australia. Around 1787 cactus plants were taken to Australia to use for the culture of cochineal insects for dye. They and other species of cacti escaped from gardens and by 1925 sixty million acres were so covered with prickly pear nothing could be done about it, the land was useless. In 1920 a group of Australians began to search out and study the natural enemies of the prickly pear and from that time up to 1937 were able to establish several. Seven years after the first introduction of one from Argentina in 1930, 3 billion eggs of a moth, the last dense growth of the pear was destroyed and the land reclaimed and opened to settlement and livestock pro-

duction. The total cost was 168,600 Pounds, a fraction of a cent per acre—small compared to the cost of 10 Pounds per acre for the inadequate chemical and mechanical procedures used before.

Most of the material that I have just presented to you is leading toward something you have read about in Bio-Dynamics many times. You can read about it in conservation literature everywhere, and now it is cropping up more and more in popular literature as well as in agricultural and garden circles. This is the matter of natural balances in nature, what we have done to upset them and things we can do to help restore them.

There have been times in the last two and a half decades when violent methods and means of eradication of insects without thought of what these means might do to the animals and human beings eating the foods so treated seemed to be top dog. Other things were too slow. Acreages seemed too vast to deal with.

But the other point of view, that looks at the whole landscape, that finds the long-range effects of interest, that discovers that some of these 'slow' methods not only work more surely, but are often more economical, is now appearing everywhere. In the Foreword of the 1952 Yearbook of Agriculture, Charles F. Brannan, then Secretary of Agriculture, says more on one page than many articles could do. Just to quote a few of the many significant sentences: "Although the science of entomology has made great progress in the past two decades, the problems caused by insects seem to be bigger than ever. We have more insect pests, although we have better insecticides to use against them and better ways to fight them. . . . Many aspects need to be considered in the control of insects. We must stop the destruction of our crops and forests, but the insecticides we use must leave no dangerous residues on foods, destroy no beneficial wildlife, and do no damage to our soils." Mr. Brannan also speaks of the difficulties which appeared in connection with the use of 'miraculous' DDT, the various species that appeared in the end to be DDT resistant. And it is not only in the foreword that one finds material and information of the same general character but everywhere in the numerous fact-packed articles throughout this valuable fat book.

Another instance is found in an article on Garden Pests which appeared in the July 1953 issue of CONSUMERS REPORTS. Here on not quite two pages this changed attitude is revealed again and again. Many things which Dr. Pfeiffer

has said in the past and which have been proven in B. D. practice are corroborated here. For instance: "It has long been observed that well-fed, vigorously growing plants are less subject to pests than those that are poorly nourished or weakened in other ways. . . . From other experimental evidence it appears that although good plant nutrition may not solve all disease and insect problems, protection of plants from pests certainly begins with soil improvement." Then again, in a paragraph which deals with DDT and other 'miracle' killers: "Worse than this is the effect of some of these materials on the soil. Long ago it was found that the soil in orchards which had been sprayed heavily for many years with lead arsenate could not grow vigorous trees, and recent tests indicate that some of the new insecticides are even more harmful than lead arsenate. In the opinion of CU's consultants, home gardeners should avoid the new poisons except in emergencies, and should not use any pesticide oftener than is clearly needed." This is certainly a contrast to the many bulletins we have all received as orchardists or gardeners on the numerous 'necessary' sprayings of so many lethal mixtures in recent years, or the ads recommending the 'all-in-one killer-diller' in the 'convenient applicator cartridge package.'

There is other material too, much of it about what is now called biological control of insect pests. An article, Insect Commandos Aid the Orchard, by Weldon D. Woodson, in the March 1953 issue of NATURAL HISTORY, presents the fascinating story of the control of the oriental fruit moth in the orchards of California. They first discovered it there in September 1942. The wormlike larva of this moth burrows into the tips of growing shoots, causing the terminal leaves to wilt and die. Or else they tunnel into the fruit itself, peaches usually, producing wormy peaches. The Californians determined at first to wipe the pest right out. Then they discovered that it was too big a job and set to work on the study of biological control. There was a native ichneumon fly which had been discovered in the east and used successfully in the control of this pest. So they sent east for some of the parasites from which to produce others for the campaign against the moth. The female of this small creature has an ovipositor about as long as her body (she is about the size of a mosquito) and she rushes about locating the holes in the twigs where the larva have burrowed in and lays an egg on the body of the wretched creature. If she can't find any more

twigs right around home she will fly off as far as 6 miles to another infected orchard. She is also a valuable warrior because she can produce as many as 500 eggs in the course of her 34 day life cycle. In 1946 the entomologists succeeded in producing about 29 million and about 23 million were shipped to orchardists in 14 counties. This seems to have checked the spread of the oriental fruit moth so effectively there that it is now reported only from a few backyard gardens in one of the 14 counties.

The practice of biological control is considered to be new, modern expressions are used to describe it, and yet there are recorded instances as early as 1775. Peter Forskal a Swedish naturalist wrote then of how in 1761 Arabs in Yemen brought ants down from the mountains every year to control other ants which were destroying their date palms. This use of beneficial ants to protect orchards from harmful insect pests has been common in Asia for centuries. From the same article in Natural History we learn that the "citrus growers of south China put bamboo run-ways between the trees to aid the ants in their movements from tree to tree." Of course, the consistent use of such methods here in the West has only just recently begun to develop. We can welcome it as one more of the many indications of the growth of a new, changed point of view, a point of view that is best described in the words of Mr. Brannan: "We dare not think of any knowledge—least of all knowledge of living things—as static, fixed, or finished. We need to push on to new horizons of thinking and investigation and, reaching them, see newer horizons. We need a longer view in research and an appreciation that it can have two goals: First, practical, everyday results that can be expressed in terms of definite methods, tools, and advice, and, second, fundamental, basic knowledge, on which the applied science rests. . . . We need to keep the second goal always before us, remembering that science and knowledge are ever-growing and ever-changing."

NEWS FROM ROANRIDGE HOMESTEAD, PARKVILLE, MISSOURI

JOHN AND HELEN PHILBRICK

The Philbricks need no introduction to regular readers of Bio-Dynamics. This still-young Episcopal clergyman and his wife have written for us in the past of their own homestead at Duxbury, Mass., and its development, along the healthy road of careful testing and practical experience, into a bio-dynamic unit. Now, called by their church to help instruct others headed for rural work, they have already spent a fruitful 5 years starting a new development from scratch. In their usual modest fashion, they definitely understate in the brief report that follows, what has been going on at Roanridge Homestead.

In the five years that have elapsed since we first came to Missouri enough has been accomplished for us to make at this time a little report. The main purpose of Roanridge is to be a training center for men who intend to go into Town and Country Ministries, and this is the central thought in every aspect of the work. The seminary students and women workers come here in the summer for two sessions, one for orientation at the beginning of the summer and the other at the end of the summer after they have worked in town and country churches all over the United States during the summer months. During these two sessions the students receive formal lectures and informal teaching on various aspects of rural sociology, parish adminstration, Christian Education and the church in its relation to the community.

The Roanridge Homestead has been built and planned with these students in mind using the following definition: " 'Homestead' as used today simply means a plot of land ranging in size from a fair sized lot to several acres on which a family lives and applies varied agricultural activities. This productive use of small plots of land is as old as backyard gardens. But application of modern 'homesteading practices' changes the backyard garden into a highly efficient, dramatically interesting and valuable food-producing unit. It improves the economic standard of living, but most of all it improves the quality and character of family life. As vast numbers of families are moving from the cities into suburban and rural sections, they find in the homestead idea both economic and social values. Their proper

use of the land improves their standard of living and their whole way of life. The practice of homesteading has an obvious application to the life of the rural minister and to the role of the church in the rural community."

At every opportunity single students or groups are brought up to the Homestead to participate in the different activities. While nothing is compulsory, the opportunity is given for students to learn to milk the goats, to kill, pluck and dress poultry, to prepare poultry and vegetables for the deep freeze and to build a compost heap. Those who are interested in studying deeper into any of these subjects have access to a good library of both books and magazines.

It was a great help when we began to plan the Roanridge Homestead to have access to some practical suggestions developed by B.D. homesteaders in Europe. The area surrounding the house was planned accordingly as the Intensive Zone, which contains the area and activities most directly related to the house and the family: the barn, compost heaps, rain barrel, cold frames and gardens. Our cold frames are on the south side of the house which places them on either side of the front door. The flower gardens, containing many herbs, surround the house and border the small front lawn. A pit greenhouse, 8 x 8 feet square was built onto the house at the east end. Visitors coming through the front gate can easily be piloted around the house, past the cold frames and greenhouse while we explain the different activities to them. The compost yard and vegetable garden are next where there are several examples of companion plants which are mutually beneficial to one another.

We were able to put up a strong wire fence with a good selection of shrubs which we hoped would protect the Intensive Zone from the wind. We had not, however reckoned on a drought year. Most of the shrubs came through the summer with a good deal of extra watering, but the few leaves they managed to unfold against the hot dry wind hardly showed in the burning summer sun. When the giant ragweed and pigweed grew six feet and eight feet tall, we left them to protect and fence in the garden and compost yard. When the plantings of berry bushes have grown about twice as tall as they now are, they should form a windbreak to keep the strong west winds out of the vegetable garden. The equally strong and dry south wind will eventually be somewhat broken, we hope, by the orchard trees and grapevines growing on the wire fence. The

strong wind blowing incessantly across the top of this hill keeps plants and animals and people constantly on guard against an unseen force that whistles over the top of the chimney and roars into the fireplace inside the house.

The path from the back door leads very straight to the little red barn which houses the three milk goats, a sheep and her lamb, and a partitioned-off section which houses about 12 hens. We try to remember to say over and over again that the most important thing about a clergyman's homestead is to keep each unit small. Twelve hens supply more than enough eggs during the laying season, and the chicks they hatch out are ample for fried chicken for a small family. More than three milk goats would give too much milk, but by having three, and by arranging their breeding dates throughout the year, we can, in theory at least, have a constant milk supply. The annual spring lamb is destined to go into the deep freeze. The sheep's wool goes into comforts for the Ladies' Aid to quilt. Sometime there will be a pig. At present the goats and sheep graze with the Roanridge Shorthorns in pastures outside the Homestead.

The three hives of bees on the outer edge of the intensive Zone with some apple trees nearby form the beginning of what we plan for the Bee Yard with some honey plants cultivated nearby as much for educational purposes as for the bees' use. It is often noticeable that present-day young people really understand very little about the processes of agriculture, but we have found many people responsive to explanations about the bees. There is pictorial record of the interest this summer's students showed when we opened the hives one day in August with half a dozen students craning their necks to see what was inside.

Fortunately this land was once a field of alfalfa and there is good fertility in spite of a tough clay soil. Before we were living here, we began to treat the garden soil with Dr. Pfeiffer's bacterial starter and B-D Compost and we have noticed tremendous changes in the texture of the soil even over a few months. In mid-July one "patch" was so cloddy that we could only hack out some furrows to plant string beans. We scattered some compost in the "furrows" and watered with the hose because there was no rain. By the first of November the effects of the compost had worked through the clods until every part of that bed is now soft and fluffy to handle. Tomatoes planted in the asparagus bed and mulched not only provided an ample supply of tomatoes but also kept the asparagus entirely free of weeds.

One large flax plant growing beside a 20 foot potato patch kept away the potato bugs. Those potatoes were planted by a missionary from India and were harvested by students from several American seminaries. Because of the clayey soil and the lack of rainfall there was more education in the crop than potatoes!

Probably the majority of the readers of *Bio-Dynamics* subscribe to the magazine because they already have concern for the land and for the processes of agriculture. The greatest challenge of our job here is to help people see enough of these homesteading projects to develop their own concern. We hope that young people especially will begin to rediscover the earth we live on as something to which we are intimately related, not as something we try to overcome. Instead of being only a Walt Disney creation, Mickey Mouse and every other living creature has a larger place in the world of Nature and we see it as part of our work to help people to become better aware of their own relationship to the earth, the plants and the animals.

OUR SALAD GARDEN

CHARLES W. EDDY

"Fools rush in where angels fear to tread." Recently one of us was talking with a Rhode Island farmer. This agricultural gentleman was bragging about the wonderful results that he was getting from his farm, so one of us mentioned a few of the practices in which we were interested. The Rhode Island farmer said, "You can't raise anything that way." "You should have told us five years ago," said one of us, "and we wouldn't have been doing it for all of these years." Sometimes it pays to be ignorant. If we had been wise, we would have known what had to be done in order to have a good garden, and we could have done it. By the reverse process of reasoning, we would have known what was impossible and we wouldn't have done it. Not knowing too much about the orthodox practices, we have gone ahead, using nature's textbooks principally for guidance, in agriculture and nutrition, and have obtained some unusual results.

We eat Bio-Dynamically raised products, and use the Bio-Dynamic methods of agriculture, together with some of our own practices.

Because we are interested in two other projects, quite foreign to farming, this year is the first in 23 that we have spent the major part of the summer here in Rhode Island instead of on our Vermont farm.

When we learned that we were to stay here all summer, and knew that we would not have the vegetable garden to which we were accustomed, we thought that we should at least try to have a salad garden right here in our own back yard.

First we got out seed catalogs and made a list of what we thought would be sufficient to supply us with our main meal, our supper, for the summer months.

We thought that these vegetables and herbs would give us an ample supply for ourselves and our daughter, her husband, and family of five children, who live in the other side of our house: Lettuce, 65 plants; cabbages, 9; onions, 74; peppers, 9; tomatoes, 6; stinging nettle, 4 (to benefit the tomatoes) ; parsley, 8; radishes, 2 9-foot rows; celery, 12; cucumbers, 6 hills; a few beets; a few carrots; nasturtiums, to eat, keep the squash bugs away, and produce more flavorsome radishes; white geraniums, 4, to use as beetle traps; and the following herbs: Pineapple mint, 2; rosemary, 2; sage, 1; summer savory, 1; orange mint, 2; apple mint, 2; sweet basil, 1; sweet marjoram, 1; burnet, 1; costmary, 1; French sorrel, 1; chervil, 1; broad leaf chive, 1; old-fashioned chives, 1 bed; winter savory, 1; lemon balm, 1; lemon thyme, 1; tarragon, 1; garden cress, 2; and camomile, 2 (camomile is not eaten, but the flowers are used for making tea, and for medicinal purposes).

Then we figured, by consulting seed envelops, the amount of space that would be necessary to raise all of these things. The result of our figuring was a garden 30' x 35' or containing 1,050 square feet. All of the space that we had allotted for this garden was two small areas each 5' x 10', or a total of 100 square feet.

Although we had experimented, at the farm, by planting some things closely together, we had never attempted such concentrated planting as was necessary to raise all these more than 250 plants in this 100 square feet.

Lettuce, radishes, and a few of the other vegetables were planted the first of May. The remainder of the vegetables and herbs were all set out the 18th of May. Starting the first of June, the major part of our supper each night, excepting for a dessert made with honey, has come from this salad garden.

At first we had a salad composed of lettuce, radishes, and several varieties of herbs. From time to time all other vegetables were added, including parsley, cabbages, peppers, tomatoes, cucumbers, onions, garlic, carrots, and beets. All of these were made into a raw salad and served with a dressing made with lemon, honey, and olive oil.

From our garden we had one radish 3¼″ dia. and a white icicle radish 1½″ dia. and 9″ long. Both of these were not strong or woody but tender, firm, and delicious in flavor. In some places the foliage was three plant stories high. In order for them to get the light, the nasturtium stems grew 24″ long. The cucumbers, climbing poles with the benefit of cloth tapes, grew to be 5′ tall. Cabbage plants were 36″ dia. and some of their leaves were 16″ across. We have already harvested some of the cabbages and started to raise a second crop on the same plants.

Many practices must be employed in order to construct and maintain such a salad garden: No cultivating (there isn't room), no weeding (weeds also have no room and few appear). We get the benefit of bacteria normally in the soil, earthworms, Bio-Dynamic preparations at planting time, compost, mulching and companion planting. Every plant is placed near a friendly neighbor, which will assist in some way its development, either by directly benefiting, enriching the soil, increasing the keeping quality after harvesting, attracting birds, or directly helping in pest control.

A one inch mesh, three foot wire fence was erected around the salad garden to exclude the four- and two-legged bunnies, of which five live in the other side of our house. And last week, for example, we eliminated more than 400 Japanese beetles outside of the fence-enclosed area. Inside of the two salad gardens we found only four, one on a cucumber leaf and three on the stinging nettle.

These gardens may be successful in a back yard of any small lot, even that connected to a row house. Because of the roses, nasturtiums, white geraniums, flowering vegetables and herbs as well as the large variety of many shades of green foliage, these gardens are also a pleasing addition to any front yard.

Bio-Dynamics Circulation Note—Thanks to Mr. Charles Eddy and his garden, which was written up in the Providence Sunday paper last September, so much interest in Bio-Dynamics has been aroused there that now Rhode Island is in third place as to states in our circulation,—New York, California and Rhode Island.

RAW MATERIALS USEFUL FOR COMPOSTING

E. E. PFEIFFER

The content of chemical components valuable as fertilizer, ease of handling and transport, as well as structure and moisture content, are decisive factors for the compost manufacturer in determining to use raw materials for composting.

From the biochemical point of view, the adaptability of these materials to compost fermentation is important. One should know whether the materials will decompose and in what way, the specific structure, whether aeration is necessary or not, the moisture content and bacterial action needed for producing the best results. Obtaining such information is the task of the Research and Field Laboratory.

Finally, the finished compost should lend itself easily to bagging and shipping. Its agricultural fertilizer value should be determined in order to prepare sales promotion and proper distribution to the customers, bulk to farmers and retail to home gardens and the nursery trade. All these factors, processes and problems should be well-known and understood before a decision is made to use any specific raw material for composting. The Biochemical Research Laboratory has done a great deal of valuable research and has accumulated a wealth of knowledge and information in this field. The following raw materials have already been investigated in regard to their value and usefulness:

Bagasse and Filter Mud	Municipal Garbage
Cannery Wastes	Peat and Muck
Coffee Grounds	Sawdust
Corncobs	Sludge
Cotton Gin Wastes	Straw
Fishery Wastes	Synthane Chips (a plastic)
Hair	Water Hyacinths & Seaweed
Manure (all kinds)	Wool Wastes

The following table lists some of the major chemicals contained in the raw materials investigated thus far. Since nitrogen is the most important factor in the final analysis of the product and the moisture content is essential in handling, these analyses should be made at once. In addition the phosphate, potash and trace mineral contents are determined. The methods used for the analyses are standard A. O. A. C.*

* Where not otherwise noted, all analyses were made by the Biochemical Research Laboratory, Spring Valley, New York.

I. ANALYSIS OF SOURCE MATERIALS

Kind of Material	% O. M.	% Moist.	% Ashes	%N as rec'd	%N dry basis
Bagasse		21.4		0.3	0.4
Bagasse - newspaper		dry		0.2	
Bagasse - Puerto Rico	77.1	20.3	2.6	0.42	0.53
Blood Meal		dry			10-13
Cachaza - Cuba	25.2	72.5	2.3	0.9	3.3
Cachaza - Puerto Rico	18.2	70.7		0.88	2.5
Castor Bean Pomace		9.9		5.96	6.62
Cocoa Tankage		61.6		0.9	2.3
Coffee Grounds		67.9		0.6	1.9
Cotton Mote Cleanings		4.7		1.09	1.14
Chrysanthemum Residue	86.0	6.0	8.0	3.0	3.2
Fish Meal		3.9-10.8			9.5-10.8
Grape Pomace, distilled		61.7		0.9	2.4
Guano, Chilean		25.0		5.0	6.67
Hoof & Horn Meal		8.75		12.11	13.27
Kenaf Wastes		11.0		3.2	3.6
Licorice Root		32.6		0.78	1.16
Olive Seeds & Marc (low)		7.8		1.5	1.6
Olive Seeds & Marc (high)		9.0		1.74	1.9
Seda Humus Co. Peat I	8.0	89.8		0.3	2.9
Seda Humus Co. Peat III		89.1		0.4	3.8
Lone Star Peat Co.		10.8		0.7	0.8
Peat - Connecticut		21.8		1.1	1.4
Peat - Minnesota	76.2	19.3	4.5	1.2	1.5
Ramie		8.0		1.4	1.5
Rice Hulls		4.6		0.7	0.7
Sawdust - Fur Waste		dry		0.4	
Sewage Sludge	45.0	6.7	48.3	1.9	2.0
Sewage Sludge, Pasadena Cal.		5.0		6.0	6.3
Sewage Sludge, Medford, N. Y.	16.6	68.7	14.7	0.8	2.6
Sewage Sludge, Chicago		30.3		1.12	1.6
Sewage Sludge, Duluth, Minn.	41.5	6.2	52.3	2.04	2.2
Sewage Sludge, Chicago No. 2	23.2	3.3	73.5	2.7	2.8
Chicago No. 11	6.3	21.0	72.7	0.43	0.54
Chicago No. 13	26.3	33.6	40.1	1.5	2.3
Sewage Sludge, Lansing, Mich.	31.8	31.8	36.4	1.1	1.6
Sheep Wool Scourings		dry		7.01	
Sheep dirt, wool, fibre		dry			8.0
Sheep dirt, wool cleaned		dry			4.3
Soapstock		39.0		0.25	0.4
Street Cleanings	38.4	15.5		0.63	0.75
Synthane Chips		1.7		0.48	0.48
Synthane Compost		24.4		0.7	0.9
Tea Leaves		41.7		0.9	1.5
Tobacco Dust		dry		2.0	
Tomato Pomace		1.1		2.97	3.0
Wattle Bark		34.8		1.05	1.61
Wood Bark - B		63.5		0.52	1.4
Wood Bark - C		61.5		0.88	2.3
Wood Bark - Canada		4.3		0.4	0.42
Wool Scouring Sludge		dry			0.5

II. ANALYSIS

Kind	% O. M.	% Moist.	% Ashes	%N as rec'd	%N dry basis
Cow, Barnyard	17-21	76.0		0.5	2.1
Cow Manure	20	77.0	3.0	0.34	1.5
Mixed, B.D. Treated	10.5	21.7	68.8	0.9	1.15
Steer, fed on cotton seed	37.0	20.0	43.0	1.39	1.75
Steer, dry	41.0	10.0	49.0	1.46	1.60
Horse	25.0	71.0	4.0	0.60	2.10
				0.70	2.40
Pig	25.0	72.0	3.0	0.45	1.60
Poultry	25.0	56.0	19.0	1.54	3.5
Poultry, dry	13.0	4.0	83.0	0.81	0.83
Poultry, with litter	27.5	60.0	12.5	1.40	3.5
Poultry, Battery	33.8	7.5	58.7	1.50	1.60
Rabbit, fresh with litter	17.6	36.4	46.0	0.64	1.0
Sheep Manure	30.0	68.0	2.0	0.85	2.7

OR COMPOSTING INDUSTRIAL WASTES

%P as rec'd	%P dry basis	%K as rec'd	%K dry basis	pH	Source
				6.0	Cuba
					New York
0.07		0.12		4.5	Puerto Rico
	5.3-9.1				Literature, average
				8.0	Cachaza varies somewhat
0.76	2.6		0.2	6.0	
2.55	2.83				Literature
				8.5	New York
				4.4	
					Texas, without cotton burrs
0.5	0.55	2.2	2.3		
					Literature, average
0.55	1.4			7.8	Algiers
14.0	18.76	2.0	2.72		Literature
4.75	5.21				Literature, hydrolized, steamed
0.45					Florida
					Algiers, de-oiled
				6.0	Seattle, Washington
				6.0	Seattle, Washington
				4.0	Lexington, Texas
					Glacial deposit
				4.0	
0.2					Florida
					Commercial
2.8	2.95	0.6	0.63		Massachusetts
3.0	3.2	0.2	0.21	7.3	Drying bed, literature, older type
0.7	2.2	0.5	1.6	7.8	
				7.6	Old, pit
1.8	1.9			8.2	Drying bed
				6.0	Open drying bed
				7.0	Open; old weathered
2.0	3.01			7.4	Open; aged
				8.0	Open
		0.56			California, literature
					By-product from refining oil wastes.
				8.5	
				7.0	California, leaves and dust
					Plastic Waste
				7.0	Starter treated
				8.0	From extraction
				6.5	
1.98	5.3			5.5	
1.72	4.4			6.0	
					Soft wood
				8.1	

OF MANURES

%P as rec'd	%P dry basis	%K as rec'd	%K dry basis	pH	Source
0.23	0.96	0.5	2.1		Literature, average
0.26	1.10	0.5	2.2		Fresh
0.30	0.37	1.1	1.4		4 mos. old, open
1.45	1.80	2.0	2.5		
1.10	1.20	3.56	3.9		California
0.28	1.00	0.53	1.75		Literature, average
0.19	0.70	0.60	2.2		Literature, average
1.54	3.5	0.85	1.8		Literature, average
1.00	1.05	0.00	0.01		California
3.50	8.75			8.3	New York Farm
2.60	2.75	1.3	1.4	7.6	Maryland, dried
1.8	2.9	0.3	0.6	8.0	California
0.23	0.7	0.67	2.0		Literature, average

For practical purposes the following descriptions of differences and variations and their significance are necessary and useful.

a. *Materials low in nitrogen,* i.e., below 0.7% nitrogen. Such materials ferment slowly due to the time needed for the transformation of carbon until a favorable carbon-nitrogen ratio is reached. During this process a high percentage of carbon compounds (organic matter) is lost. It is therefore preferable to use mixtures of higher nitrogen rating.

The price of low nitrogen materials and the cost of transportation should be very low. In fact, if they can be obtained and delivered free of cost it is preferable since they serve more or less only as "fillers." One exception might be large sawdust piles near lumber mills. Bagasse, paper, plastic chips, rice hulls, street cleanings, and wood bark are examples of low nitrogen raw materials. In general, a price of $.50 per ton, with an upper limit of $1.00 for cartage, is all that should be expended for such material.

b. *Materials of moderate nitrogen content,* from 0.7 to 1.5%, with an average of 1.0%. These materials make up the bulk of any composting process. They can be used without nitrogen correction and will produce a good compost with an average of 1.0% nitrogen. Such composts can be classified as "soil builders." Such average nitrogen bearing materials are cachaza, cocoa tankage, coffee grounds, cotton mote cleanings, garbage, grape pomace, grape seeds, licorice root, wattle bark, olive seeds, ramie wastes, some sewage sludges, also tea leaves. The price of such materials delivered to the plant should be very low, not exceeding $1.50 per ton.

c. *Materials high in nitrogen content, from* 1.5% upward. These are valuable in improving the quality of the finished product. The more of these which can be obtained, the better the compost will be. The amount to be used in mixture with low nitrogen materials will be controlled by the cost price rather than by the need for nitrogen. If enough of these materials can be used to get a fertilizer formula of better than 2.0% so that the end product can be sold as a "fertilizer" rather than as a compost or soil builder, a higher price can be paid for it since the finished product can be sold for a higher price. In general, their value can be determined by the nitrogen content, assuming that one pound of nitrogen is worth 13 to 17 cents.

The nitrogen value in commercial inorganic fertilizers, f.o.b. plant, varies from $.75 to $1.00 for ammonia, $1.20 for nitrogen solution, $2.00 for ammonium nitrate, $2.20 for ammonium sulfate, per unit. These are the wholesale prices as of Fall 1953. The prices for mixed fertilizers are, of course, higher.

The nitrogen content of the following inorganic compounds are as follows: ammonium nitrate 33.5%; ammonium sulphate 21.0%; ammonium phosphate 16.0%; nitrate of soda 15.5%; liquid ammonia (a concentrate), and cyanimide 21.0%. All fertilizers should be used in small quantities, that is in low concentrations in order not to disturb bacterial action. Organic materials high in nitrogen content are; bean pomace, blood meal, castor bean pomace, chrysanthemum waste, some filter mud on a dry basis, fish wastes, hoof and horn, kenaf wastes, pyrethrum waste, sheep wool, slaughterhouse wastes, a few sludges, tobacco dust and tomato pomace.

Such high nitrogen bearing materials should be obtained at a price of $4.00 with an upper limit of $7.00 per ton. The lower the cost the higher the profit on the finished product. In fact, these are the most profitable materials in a compost mixture. If the bulk fraction (described under b) is obtained at a very low cost, more of these addenda can be used.

d. *Manures.* These are very important and necessary addenda to compost mixtures because of enzymes and growth factors which cannot be obtained in any other way. If manures are not available or the cost is too high, a manure solution should be used consisting of one part of manure, suspended in 100,000 parts of water and added to the compost mixture.

Ordinarily 10 to 20% manure should be added to the total compost mixture. The value of manures is partly based on their nitrogen and phosphate content and partly on their intrinsic value in creating a favorable reaction in the fermentation piles.

The very best manures are cow and pigeon. The following are classified as good: steer manure, poultry (high nitrogen content, but less easily fermented than cow, goose, duck, sheep, or mixed stockyard manures). Pig manure is of medium value and horse and mule of low.

The price is generally determined not by the "value" of the manure, but by the availability in any given area. Prices vary from $2.00 to $20.00 per ton, with an average of $4.00

per ton in certain areas and $11.00 (steer, West Coast) in others. The condition of the manure, whether it is wet or dry, should be taken into consideration. The calculation of the cost price of the compost mixture will reveal how much manure can be added. Some manure analyses are reported in Table II.

e. *Soils.* Soil is an essential part of the compost mixture. Usually between 10 and 20% is used. A daily production of 100 tons of compost would require 10 to 20 tons of soil. In some areas soil is difficult to obtain. In such cases, the tailings from screening the finished compost, or the finished compost itself, can be re-circulated at the rate of 10 to 20% of the mixture. The value of the tailings is the actual cost price at the point in the process where they are removed. This will usually run from $2.50 to $4.00 per ton of air-dried material. It is obvious that soil is cheaper. In practice, soil can be stockpiled and bought at the rate of a year's supply at one time, from building excavations, road construction, drainage work, etc. Our experience has been that soil could be purchased for as low as $.50 per ton delivered, on the average, at a $1.00 per ton. Well-aerated, dry sewage sludge from drying beds, not fresh sludge, can be used as a substitute for soil. If such a sludge has a nitrogen content of more than 2.0% it is, of course, also a good nitrogen source and will be worth more. Sludges (and soils) are low in phosphate and especially in potash, and thus have a depressing effect on the P and K percentages of the formula.

Good humus soils (topsoils) are preferable to subsoils. Stockpiled and aged, as well as aerated subsoils, are better than fresh subsoils. Eventually the growth of legumes or other green manure crops on stockpiled soils should be given consideration as a means of improving them.

Not all soils are suitable for composting. Sand, for instance, is very poor, chemically as well as structurally, and does not hold moisture. Very heavy, poor, clay and adobe soils have too fine a structure to be of value since they fill all the pores and form a film impenetrable by air. The best soils are the medium heavy and humus soils. The laboratory has designed special flotation and sedimentation tests in order to determine the physical value of soils.

f. *Peat.* In general this material is not used for composting as it takes such a long time to bacterialize. Some peats are high in nitrogen which is deceptive for the compost manu-

facturer. He should not be led astray by this. Then, too, peats are usually rather expensive.

g. *Muck soils.* These can be used instead of humus and topsoils. They are high in organic matter and some are higher than 1.5% in nitrogen. Acid muck soils should undergo an aeration process before being used for composting. Neutral or alkaline muck soils can be used as is, and are excellent materials. However, the moisture content should be taken into consideration.

h. *Cannery wastes,* from fruit and vegetable canneries. These materials are usually wet and pulpy, often containing 80 to 90% moisture, which is a handicap. A special process of decomposition in pits has been designed. The muck or dry residue from these pits is excellent. The excess moisture should be compensated for if the pulpy wastes are added to the original compost mixture. If pre-fermented before use a certain price for the material is justified; otherwise it should be delivered to the plant free of cost or for a low trucking fee.

Some cannery wastes may contain a high residue of insecticides and pesticides which will have a delaying effect on the fermentation process. It has been observed that tomato skins rotted much more slowly than the inner pulp for this reason. Wastes which contain arsenic or large amounts of copper should not be used.

i. *Pomace* of any fruit, or press residue from castor beans or olives can very well be fermented and should be evaluated according to the nitrogen content. Castor bean pomace is excellent with a 4% nitrogen content; others are low in nitrogen and will do better in mixtures.

j. *Sawdust.* This is a bulk filler and adds nothing but bulk and nitrogen free organic matter. The difference between hardwood and softwood sawdust is negligible. However, hardwood sawdust makes a better compost and ferments more easily. In general, a total compost mixture should not contain more than 30% sawdust. Large chunks and wood chips are not suitable for composting but occasionally will be attacked by bacterial action. They are eventually removed in screening. Our sawdust composting experiments are still in process. *Wood ashes,* however, are high in potash, alkaline and should be used only in high dilution (1 to 5% of the mixture).

k. *Sewage Sludge* (also treated under e. Soils). A special method of sewage sludge treatment has been worked out by our

laboratory. If used in a general compost mixture not more than 30% of the total should be added. There is such a difference in sludges that each needs to be investigated separately.

l. *Industrial Wastes.* Some of the wastes, such as tea leaves, coffee grounds, cocoa tankage, filter mud from sugar cane or beet sugar processing, beet tops from beet sugar are all excellent source materials. None of these is worth more than 1 or $2 per ton, with an upper limit of $4, delivered. Bagasse and fiber processing wastes are low in value and follow the pattern outlined for sawdust. All of these should be valued on the basis of their nitrogen content.

A special role is played by pulpy wastes from fibrous plants and from cocoa and coffee beans at the source. These make excellent materials for composting but are usually not available except in plantation areas. Some of these wastes are valuable for their content in enzymes and vitamins (B complex and B12 and other extracts for raw materials for cortison).

m. *Slaughterhouse and rendering plant offal.* Blood, meat scraps and tankage are high in nitrogen content and very valuable. Bones are high in phosphate, hoof and horn meal high in nitrogen. While blood and tankage can be used as they are in amounts up to 30% of the general mixture, hoof and horn should be shredded or milled before use. Certain state laws forbid the use of hoofs and horns but it is thought that the bacterial action will render the nitrogen available and the objections of the State Chemists might be overcome upon demonstration of the changes obtained in composting. The addition of hoof and horn must be listed on the fertilizer label in some states. This matter needs further investigation.

Paunch manure is somewhat resistant to decomposition if not aerated and mixed with other materials. A general compost mixture should not contain more than 20% of paunch manure. Its nitrogen value is not too high.

n. *Fish Wastes.* These materials are medium in nitrogen content and high in phosphates and are most desirable additions to compost mixtures. 30% of the total mixture in the form of fish wastes can be easily digested in fermentation piles. Forty per cent (50% with 30% soil) should be the upper limit. This is the situation with fresh fish wastes, heads, tails, entrails. Processing wastes and dry materials can also be used to advantage.

o. *Corncobs.* These make a good material, but should be well ground and soaked in water prior to mixing with other materials.

p. *Cotton Wastes.* The nitrogen content determines the value. If the nitrogen content is too low, these materials are about like sawdust. High nitrogen content cotton wastes will react like garbage or corncobs. They should be well moistened.

q. *Filter Mud (Cachaza).* Special instructions can be obtained upon request from the Biochemical Research Laboratory, Spring Valley, N. Y.

r. *Coal Ashes* resist bacterial activation and should be avoided if possible. In many places they are mixed with the garbage during winter weather. In such cases the soil and if possible the manure content of the compost mixture should be increased.

s. *Paper.* Up to 30% (by weight) of paper in garbage can easily be broken down. It should be shredded, which is usually done in the grinding or macerating and mixing process. Paper is very beneficial in loosening a tight and sticky mixture. The paper fraction can be increased in such cases, also where the moisture content of the mixture is high. Piles containing a large amount of paper heat up more than others and need more care in regard to water supply and moisture control.

Ten per cent paper in the garbage fraction offers no difficulty. In our process printers' ink does not interfere with the bacterial action. Chemically, paper plays the same role as sawdust or cellulose material. The nitrogen content is about zero and its fertilizer value minimal. Its true value lies in the loosening property and it can be important in mixtures containing much cannery waste or other pulpy materials.

There are, perhaps, other specific materials which would be useful in composting, however, those described pretty well cover all parts of the field. Certainly a variety of combinations and mixtures can be made up from these various sources in accordance with their availability in specific instances.

THE BIOLOGICAL AND THE MECHANICAL-CHEMICAL WAY TO RATIONAL FARM MANAGEMENT

PETER BLASER

A young Swiss farmer, who came to the United States to learn about farming conditions in this country and to study the ways of introducing B.D. principles to mechanized farming, looks at the problems and possibilities of the small European farmer in his competition with highly mechanized and specialized farm operations.

There are, it seems to me, three things which above all others can be held responsible for the difference in farming conditions in this country and in Europe. The first, which is of the greatest interest to us from the point of view of maintaining soil fertility, is the fact that farming in the old world is to a large extent still based on tradition, that is to say on experiences and knowledge passed over from father to son. Of course the more or less scientific education of the young farmer and what is called the spirit of the age did their part to the disregard of those experiences and the knowledge of the basic relationship between soil, plants and animals. Also the knowledge of cosmic influences on plant growth became more and more just superstition, as its roots of truth went to the grave with those who knew it instinctively. But on the average farm, and especially on those farms which have been in the hands of the same family for many generations, a good part of the practice is still based on tradition, e.g. the preparing of the seedbed, the treatment of the manure, the management of the livestock, etc.

The next thing to mention is the relatively much greater number of people engaged in farming in Europe. You will see from four up to ten men working on a 100 acre farm. I worked on the "Ringierhof" in Switzerland, a farm with a very intensive but otherwise not unusual management, and we were eighteen to twenty people on 200 acres. Seven of us had families and we all had to live and the farm had to make some profit. This means not only that many of the jobs which are almost entirely mechanized in this country are still done by hand, but also that farming in general is far less specialized. On this particular farm we had besides the 65 dairy cows, which were milked by hand, plus young stock, a pig breeding unit with about thirty litters, ten horses, two of them breeding horses, a flock of chickens and thirty bee hives. In the field we grew, in addition to

the roughage for the animals, wheat, rye, spelt and potatoes for seed, sugar beets for the factory, string beans for market and rape for oil. There were ten acres of fruit orchard and vegetable garden. Or to take an example from Denmark where I first worked on a fruit farm on a little island. This has 50 acres, 28 are planted with fruit trees, mainly apples, pears and some prunes. But we also grew wheat, barley, oats and sugar beets for the factory; hay, fodder beets and potatoes for the cows and hogs, then cabbage, chervil, red clover and sugar beets for seed. We were five men working on this farm and had additional help at picking time.

The reason for this manysidedness might still go back to the time when farmers were almost wholly self supporting, but it also gives the farmer a greater security in the face of crop failures and changes in farm prices. Too, the more he works toward self-sufficiency, the more nearly he brings to realization the principle of the individual farm organism. On the other hand the wages of his workers do not go as far as they do here, just because there are too many among whom to divide the profits.

Or we may compare the size of what is called a family farm in this country and in Europe, and this again gives us an idea of how different the conditions are as far as the hours of work per acre of land or per production unit are concerned. In Sweden, where the farming conditions probably come closest to those of the United States because of the tremendous industrial development, but also because of the antipathy especially of the young people to work on the land, the 40 acre farm is looked upon as the ideal size of a family farm. But then by just jumping over the Kattegat, the narrow part of the North Sea which separates the Danish Islands from Sweden, we find that there a family makes a living on a 10 to 15 acre farm, and more than that: that the Danish Government has divided most of the big estates into 10 and 15 acre farms and put up farm buildings in order to give as many of the young farmers and farm workers who wanted to farm on their own a chance to do so. They rent the land but pay off the buildings over a period of years. These are only a few examples to illustrate that in most parts of Europe, except where communism has taken over, the number of farms and small holdings is increasing, due also to the parcelling out of farms to satisfy two or several successors, and that consequently their size is decreasing. In other

words the desire for an individual field of activity, for independence, takes precedence over rational management, and frequently even over a better living.

Finally I would mention as the third essential reason for the different conditions under which the European farmer is working, the fact that in most countries tillable land is extremely scarce. This again means that farms are very expensive to buy, the rents are high and the farmers' debts are in accordance. The average debt of the Swiss farmer, for instance, is 500 dollars to the acre. Consequently almost every available square foot of soil has to be made use of, and you can see Swiss farmers in ploughing a field straighten out the furrow at the turn by hand with a heavy mattock. Or in the hilly parts of the country where the fields are too steep to plough both ways they will dig a furrow along the bottom of the field, haul the earth up to the top to fill in the last plough furrow. And very seldom will you see a field getting washed out even if ploughed up and down the hill by means of a rope winch. This is due to a very careful soil management and the big part which clovers and grasses play in the crop rotation. Or instead of letting the cows out on pasture during the summer, you will see every available hand except the milkers go out early in the morning to cut and load grass for the cows, to feed them in the barn. All the manure gets collected this way and is carefully piled daily, the liquid manure being pumped or hauled out on the fields after each cut of grass. This results in 6 cuts or more during a 180 day season.

Add to this that very often farmers live together in villages, with their land scattered around sometimes more than 6 miles away, the fields being only small strips enclosed by those of the neighbors, then you can figure out how complicated the farm operation gets in the end. Certainly, much work and effort has been put in to change this. In many communities farmers came together and organized what they call "Gueterzusammenlegung." The value of each farmer's property was determined as exactly as possible, new lanes were built, the land got drained and then divided into good sized fields and redistributed to the farmers in proportion to what they owned before.

The scarcity of productive soil as compared to the population on the one hand, and the lack of knowledge, (maybe even more the absence of one-sided chemical-material theories) to bring the soil up to its optimal fertility level, and the natural

and economical factors limiting the use of modern machinery on the other hand, result in the fact that Europe, with the exception of a few countries like Denmark, is not able to produce enough food for itself. The following few figures may give us a clearer picture of this.

Production of plant food and feed-stuffs in calories:

	North America	*Europe*
Acres of productive soil per person	4.0	0.7
Calories produced per acre	2,500	7,500
Calories produced per person ..	10,000	5,200

These few statements were meant as a picture of the conditions under which the small farmer in Europe is working and may serve us as a background for the polarity of the two ways to rational farming: the biological way with quality as its first principle, and the mechanical-chemical way with quantity as its first goal.

Let us now look at this problem from a slightly unusual angle. Do we realize how big a part of farm work is just transportation, moving things from one place to another in and around the barn, from the barn to the field and vice versa? I figure it to be more than two-thirds of all the work. Because the real work, if we may use this term for the production of saleable economic value, is done by Nature for us; we can't make a single drop of milk or a grain of wheat ourselves, but we have to put the right things at the right place at the right time, and Nature will do the rest, when guided and helped in a way which does not interfere with her laws.

This might be a rather abstract idea because farming as a whole, of course, is much more than just a transportation business. But still, thinking that let us say two thirds of our work is transportation work there is only a little step to finding out that an approach to rationalization can be made along two different ways. The one which, speaking in general, the American farmer goes, because conditions and the whole line of thought are in favor of this way in this country, is doing this work to the greatest extent mechanically by using another part of Nature, namely the dead physical part in the form of machinery, gasoline, electricity, etc. The other, which in its utmost consequence first becomes possible through the introduction of

B.D. principles to farming and until now was limited to smaller farms, mostly family farms with comparatively plenty of labor, is to bring fertility, health and quality in the farm organism up to such a high level that the expenses of chemical remedies, (such as fertilizer, sprays, etc.), are eliminated. Also, that all means of production as well as every product itself which is used on or sold from the farm is in top condition, which in turn means that the handling of practically worthless bulk is reduced to a minimum.

To get a clearer picture of what is meant here let us take as an example a load of hay, let us say 3 tons, enough to feed 10 cows, for a period of approximately three weeks. I don't have to tell you that the production of milk as well as the state of fertility and health of these cows may vary greatly, depending on the quality of the feed and the inbred qualities of the cows.

But let us just look at the difference caused by the quality of the hay which might result in the production of 5,000 lbs. of milk at the lowest and 9,000 lbs. at the best—the difference being 4,000 lbs. of milk out of 3 tons of hay. Now it may take the mechanized farmer with his modern equipment 6 working hours to harvest the 3 tons of hay and 20 minutes daily to feed it: that's 7 hours in 3 weeks. He may now have a production of 5,000 pounds of milk in 13 working hours, considering only the time for harvesting and feeding the hay. The small farmer does not have all this equipment and can't afford it. What is he going to do? It may take him 15 hours or more to put his hay in, but in this time he is able to give it the most careful treatment including weatherproof, protein-saving drying on tripod-racks. Then it may take him 40 minutes a day or 14 working hours to feed it in small rations at a time, to avoid spoilage and keep up appetite, or even supplementing it with a handful of aromatic herbs, (such as the herbs used for the compost preparations, for cooking or for medicine), to stimulate digestion and milk production. Altogether it may take him 30 working hours for the same operation for which it takes the mechanized farmer only 12 to 14 hours. However the special care and treatment by means of tripoding, which is general practice on good farms in Europe, and the supplementation with home grown herbs, which was an old-time practice in Europe (and is being taken up again by B.D. farmers in Germany with excellent results) make it possible for him to produce the maxi-

mum of 9,000 lbs. of milk. In addition, soil fertility, and the state of health in the herd, will increase. This is especially the case if the hay field is treated with carefully prepared compost, an operation which pays for itself under European conditions.

The Danish farmer Peter Madsen, for example, is producing now after six years of B.D. management 1 kg. of butterfat on 5.7 Danish feed units while the average herd requires 6.5 feed units for the production of the same amount of butterfat. This means that in Peter Madsen's feed there is 14% hidden feed value, which is not there in other farmers' crops.

Or as another example, the farmer Konrad Schlecker in Germany brought his average milk production per cow from 5,200 pounds before converting his farm, up to 9,980 pounds after four years. In addition he now raises most of his young stock, both heifers and bulls, and is selling them at top prices for breeding purposes. I was astonished at what careful and consistent B.D. management means for the success of the farmer, when I saw his herd and farm last year.

In this way, concentrating on the production of the highest possible quality, and thereby cutting costs by reducing the transportation and handling of worthless bulk, the small farmer under European conditions may be able to get as much out of his work as the mechanized farmer does who would not bother with all these little things. And the time may come when the consumer is willing to pay more for B.D. quality food just as he is now willing to pay more for a quality watch. We could take as another example the production per acre of land under different care and treatment, or we could outline the two approaches to a rational farm management, the one from the quantitative mechanical side, the other from the qualitative side, and extend my few statements to a comparison of the farm operation as a whole. But having in mind the two ways strictly separated: mechanization by all means being the one, qualitative improvement, no matter how much hard work there is involved, the other, both ways would finally lead us to a dead end. The one because the disregard of the qualitative factors in farming would lead to a complete deterioration of the soil, of the regeneration and the formative forces of the cultivated plants, and of the constitution of our animals which in turn would result in the production of food that might fill our stomach but would not nourish us any more. The other because without the help of machinery and labor-saving devices, farming is such a tough

job that still more people would quit it, and although food of top quality might be produced it would be so expensive to buy that most people could not afford it.

But the answer never lies in extremes, and luckily enough the principle of quality can to a certain extent also be introduced to mechanized farming, and the modern farmer will have to combine both ways so that his products fulfill the minimum requirements of quality demanded by the consumer, and so that his management suits the special conditions on his place and in his area.

The point where finally all comes together, however different the conditions may be, is the farmer himself as the creative organizer of the individual farm organism.

SAVE THAT PEEL

If you are lucky enough to get oranges—and other citrus fruit—not sprayed with poisons, remember there is much nourishment in the skin too. One handy way to save it is with that gadget used to peel potatoes or carrots. It takes off the colored part of the skin before you cut into the orange. Drop it onto a platter and set to dry on some high, warm shelf. Be sure the peel is crisp dry before you store in mason jars. Or you can grate the peel, also before cutting the fruit, directly into honey where it will keep indefinitely. Packed down thus, it is all ready for cakes and cookies.

The peel strips can be candied if you like. Also they can be added to a good many herb teas with advantage, even to ordinary tea, especially if it is the green rather than the black variety. For festive occasions the Chinese always add something special to their teas,—jasmine, rosebuds, chrysanthemums, small fruits, ginger, etc. In Chinatown you can get fresh ginger root. Make your own candied ginger in syrup rather than the dry, sugar-rolled kind you buy so expensively. Or cut the fresh root in pieces not much larger than a pinhead and dry them. A few of these ginger pieces (hot stuff, not too much), some orange peel and a little green tea steeped togther as you would ordinary tea—a delicious drink, with or without honey sweetening. But don't mix such things until you are actually making the brew. Store your various ingredients separately.

Here is an old recipe from China for PRESERVED GINGER in syrup. Get young and tender roots, clean and cut into pieces, rejecting what is too tough. Cover with cold water and bring to boiling. Drain and cover again with cold water, allowing it to stand thus until the next day, then boil again. Repeat this process for seven days, when the ginger will be tender and not too hot.

After the week's boiling, weigh the ginger and allow 1½ pounds of sugar and one cup of water to each pound of ginger. Boil sugar and water to a syrup and pour over ginger. Allow all to stand until next day, then pour off syrup, boil again and pour back onto ginger. Do this for three days. Do not boil ginger and syrup together. After three times boiling the syrup, pour over the ginger and bottle the whole. (Use fresh ginger root from Chinatown.)

CANDIED ORANGE PEEL

Use only the colored part of the peel. Cut into pieces of desired size, cover with cold water and bring slowly to boiling point. Drain, weigh peel and add an equal amount of sugar (or part honey) and a pinch of salt. Over low heat toss until sugar dissolves. Simmer until it reaches the soft ball stage (238 degrees) when the peel should be somewhat translucent. It may be bottled as it is, or the peel may be lifted out and rolled in granulated sugar.

GOLDEN LIME OR KUMQUAT PRESERVES (as served in Chinese restaurants.)

Wash fruit, removing stems, and make several holes in each with a darning needle. Place in boiling water in the proportion of 1 quart of water to 2 quarts of fruit. Simmer slowly until fruit is tender but *still whole.* Lift fruit out and add 5 cups of sugar and boil five minutes. Add fruit and cook very gently for an hour or until the fruit is clear. It should not go to pieces. Bottle while hot. Fruit is served whole, each on a toothpick. Syrup is delicious sweetening for tea.

HOW DO THE NEW INSECTICIDES AFFECT PUBLIC HEALTH?

As laymen many of us in the Bio-Dynamic movement have often speculated about the long-range and widespread effects of the increased use of DDT and other even more powerful new insecticides on the health of people in general. We have come across brief references from time to time, but never enough evidence to bring issues out clearly. Recently, a vigorous and fact-packed article by Morton S. Biskind, M.D., *PUBLIC HEALTH ASPECTS OF THE NEW INSECTICIDES*, was brought to our attention by a news report in the NEW YORK WORLD-TELEGRAM. The article appeared in the November 1953 issue of the THE AMERICAN JOURNAL OF DIGESTIVE DISEASES.

We learn here, in the first place, that when DDT was released in 1945 for use by the general public in the United States and other countries, it was done against the advice of investigators who had studied the compound and found it was toxic to all forms of life. "In rats, mice, rabbits, guinea pigs, cats, dogs, chicks, goats, sheep, cattle, horses and monkeys, DDT produces functional disturbances and degenerative changes in the skin, liver, gall bladder, lungs, kidney, spleen, thyroid, adrenals, ovaries, testicles, heart muscle, blood vessels, voluntary muscles, the brain and spinal cord and peripheral nerves, gastrointestinal tract and blood. The compound is equally dangerous to birds, fish, crustaceans, lizards, frogs, toads and snakes." In reference to the effects on fish and crabs Dr. Biskind refers to a report by H. R. Mills in the Audubon Magazine on what happened in the Tampa Florida area after repeated spraying of DDT for mosquito control. Each successive spraying increased the dead fish and crabs found on the beaches until they were finally literally covered with these corpses. Analyses of the tissues of the crabs and fish were made and varying concentrations of DDT were found. Besides all this the sprayings did not control the mosquito situation at all, indeed the mosquitoes have increased and are more numerous than they were before.

"It was even known by 1945 that DDT is stored in the body fat of mammals and appears in the milk," Dr. Biskind further reports. "With this foreknowledge the series of catastrophic events that followed the most intensive campaign of mass poisoning in known human history, should not have surprised the experts. Yet, far from admitting a causal relationship so obvious

that in any other field of biology it would be instantly accepted, virtually the entire apparatus of communication, lay and scientific alike, has been devoted to denying, concealing, suppressing, distorting and attempts to convert into its opposite, the overwhelming evidence.—And a new principle of toxicology has, it seems, become firmly entrenched in the literature: no matter how lethal a poison may be for all other forms of animal life, if it doesn't kill human beings *instantly* it is safe. When nevertheless it unmistakably does kill a human, this was the victim's own fault —either he was 'allergic' to it (the uncompensable sin!) or he didn't use it properly."

He then points to the fact that people in general do not realize what vast quantities of these poisons are used nowadays not only in agriculture but in homes, in hospitals and in food processing plants and retail shops. In agriculture alone 252 million pounds were used in 1952.

Following a consideration of the relation of DDT to "virus X" in animals and human beings, Dr. Biskind outlines changes in the incidence of known diseases which paralleled the appearance of the "virus X disease." "The most striking of these is poliomyelitis. In the United States the incidence of polio had been increasing prior to 1945 at a fairly constant rate, but its epidemiologic characteristics remained unchanged. Beginning in 1946 the *rate of increase more than doubled.* Since then remarkable changes in the character of the disease have been noted. Contrary to all past experience, the disease has remained epidemic year after year. It has largely lost its seasonal character, although still most prevalent in the Summer. More adults acquire the disorder than ever before. More cases of bulbar involvement are seen."

He shows that these changes are not exclusively observable in the United States. They have been evident in places as far apart as Mexico and Israel. "In the Philippines and elsewhere in the Far East American troops, who used vast quantities of DDT as insecticides, had a high incidence of poliomyelitis, while it was extremely low in the surrounding native population." The same low incidence has been observed among the Arabs in Israel.

There have also been increases in the mortality from various heart disorders. Again, "the rise in the incidence of hepatitis in the general population since 1945 is also without parallel and involves all age groups, including young infants. Information as to total morbidity from this disorder is obviously

unavailable but even a cursory survey of recent medical literature shows that hepatitis is now one of the major medical problems. Most of the reported cases are considered 'infectious', although the virtual impossibility of diagnosing the 'infectious' nature of a given case or of demonstrating the transmissibility of the disease must be obvious even to the casual observer, since human infectious hepatitis can be transmitted only to man. The most curious aspect of the rise in hepatitis is that simultaneously this has occurred for instance in cattle, in dogs and in other farm animals."

"It would be a most remarkable coincidence if several entirely different hepatic infective agents, each specific to a different animal species, arose simultaneously. Human infectious hepatitis is not transmissible to dogs or cattle or vice versa. How then account for this situation?"

DDT, of course, is not the only toxic poison in use today, there is chlordane, benzene hexachloride, lindane, aldrin, dieldrin, parathion, and others. Chlordane, for instance is widely used for the control of roaches in houses, hospitals, etc. It has been found to appear in the body fat very rapidly in high amounts and is retained for very long periods of time. One of its components, heptachlor, is changed in the body into an even more poisonous substance and stored in this form. Dr. Biskind tells of a house where chlordane was used in the foundations against termites. The result was that the house could not be lived in by the owner because of the high vapor concentration. Another case quoted, concerns a hospital and the resident nursing staff. "In a hospital in which technical chlordane is applied routinely in the kitchen and food storeroom and less regularly elsewhere in the institution, for roach control, an epidemic of hepatitis has persisted among the resident nursing staff for three years. This disorder was considered 'infectious', yet despite adequate epidemiologic precautions the cases continue to appear. The chlordane is still in use."

One of the most significant factors in the whole problem is the persistence and stability of almost all of these various new compounds. DDT can be found in toxic amounts in soils after seven years. Chlordane persists in building interiors, for instance, witness the house that was treated for termites. Then there are all the new mechanical gadgets which are on the market for use in homes, restaurants, and stores, to vaporize these poisonous compounds. There is even an electric light bulb

with a pocket in which to put pellets which are then vaporized! Besides, many of the compounds are now added to crankcase oils, to floor waxes, to wallpaper, to every mothproofing compound. These vaporized materials are not only breathed in by human beings, but they recrystallize on wall surfaces, etc., and very likely upon food, table surfaces and so on.

Information of the sort given by Dr. Biskind in this article deserves the widest possible circulation in order to arouse the general public to the dangers entailed in their use, dangers which are often pointed out in brief articles in newspapers and magazines but at the same time overshadowed by advertisements advocating their use.

NOTE ON COMPANION PLANTS

Although our leaflet on COMPANION PLANTS has been out of print for several years, we still get frequent requests for it, so we are glad to announce that the material is again available.

Miss Warner of the Ohio Earthworm Farm asked our permission some time ago to reprint it in connection with her earthworm information. Copies of a combination leaflet are just out and may be had for fifty cents from Miss Bernice A. Warner, Fox and Warner Lanes, Worthington, Ohio.

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